



## **DVI-250 System Operation and Installation Manual**

**DOC0111**

**Applies to the following PN:  
DVI-250A, DVI-250C, DVI-250AP, DVI-250CP,**

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## **1 ABOUT THIS DOCUMENT**

### **1.1 Purpose**

This document provides information and specifications required for installation of the DVI-250.

### **1.2 Scope**

This document is intended for DVI-250 installers and operators.

### **1.3 Definitions, Acronyms, Abbreviations**

<b>Acronym</b>	<b>Description</b>
STS	SkyTrac Systems Ltd.
DVI	Dispatch Voice Interface
CDP	Cockpit Display Panel
PCB	Printed Circuit Board

## **2 GENERAL**

### **2.1 Introduction**

This publication provides technical information for the DVI-250 Sat/Com control head. The DVI-250 provides a sat-phone and pre-programmed text message interface to SkyTrac Systems' ISAT-100.

The DVI-250 can also be interfaced to the CDP-250 Cockpit Display Panel to provide full 2-way text message support.

SkyTrac System's Iridium based ISAT-100 combined with the DVI-250 provides true global voice and text communications.

### **2.2 Description**

The DVI-250 has a small, easy to use form factor well suited to the demanding environment of working aircraft.

The DVI-250 consists of a DZUS rail mounted keypad, a number of indicators and a locking toggle or push button switch. The keypad is used to dial numbers and send pre-programmed text messages. The indicators indicate incoming calls, text messages, ISAT communications status and errors. A front panel locking toggle switch or push button switch is used to trigger the ISAT emergency mode.

The two models DVI-250C DVI-250A are identical other than the NVIS classification. DVI-250C is a commercial grade Night Vision Goggle (NVG) Friendly Green backlit panel. DVI-250A is a NVIS A Night Vision Goggle (NVG) Compliant panel.

The two models DVI-250CP, and DVI-250AP, are identical to the DVI-250C and DVI-250A models except a pushbutton switch is used in place of a locking toggle switch for activation of the ISAT Emergency mode.

## **2.3 Purpose of Equipment**

The DVI-250 is designed to provide an easy to use interface to the ISAT-100. The interface enables the user to make Sat phone calls by either dialling the complete number or using quick dial list.

Pre-programmed text messages are also supported, allowing users to get important information to the ground in an efficient and timely manner without distraction from the mission.

Thru its interface to SkyTrac's ISAT-100, the DVI-250 enables the user to send pre-programmed text messages and dial pre-programmed and manual phone numbers from anywhere in the world.

## **2.4 System Requirements**

The DVI-250 requires an ISAT-100 with up-to-date firmware to operate.

### 3 SPECIFICATIONS

DVI-250A MOD A and DVI-250C MOD A are qualified to the DO-160E environmental category

[(A1)(F1)]-CXB[(SBM)(UG)]XXXXXXXXZBBXXXMXXXX

#### 3.1 Physical Properties

Operating Temperature	-15°C to +55°C
Size	L: 3.4" (86 mm) excluding connectors and emergency switch H: 1.12" (28.4 mm) W: 5.75" (146 mm).
Weight	0.27kg (0.6 lbs)
Mounting	DZUS rails using 4 1/4 Turn Studs.
Cooling	Normal air circulation required.

#### 3.2 Technical Specifications

##### 3.2.1 Optical Specifications

###### Indicators Brightness:

Day Mode: 150 fl Minimum.

Night Mode: (dimnable from Day Mode)

###### Backlighting Brightness

Day Mode: NA

Night Mode: 1 fl +/- 0.5 fl (dimnable)

###### Display colours:

<b><u>Indicators</u></b>	<b><u>DVI-250C</u></b>	<b><u>DVI-250A</u></b>
DATA DELAY	Yellow	NVIS Yellow A
Activity	Green	NVIS Green A
MSG IN	Green	NVIS Green A
Panel Backlighting Green	Green	NVIS Green A

### 3.2.2 Electrical Specifications

Power Requirement: Nominal standard 28VDC system bus via 3 Amp breaker.  
**\*Actual consumption** is 0.03 Amp typical, 0.05 Amp while indicators are on. (Equipped with reverse voltage and transient protection).

Maximum Supply Voltage +32.2V DC  
Nominal Supply Voltage +27.5V DC  
Minimum Supply Voltage +20.5V DC

Abnormal surge voltage +40.0V DC for 100 msec.  
+37.8V DC for 1 sec.

### 3.3 DVI-250 Installation Kit

The Installation Kit for the DVI-250 is PN: **STS0011**. The parts contents of the Installation Kit can be found in the latest revision of the DVI-250 Installation Kit Bill of Materials (DOC0170). It contains mating connector to the DVI-250, back shell and necessary hardware to attach it.

## 4 AIRWORTHINESS LIMITATIONS

### 4.1 Installation Limitations

No Installation Limitations identified.

### 4.2 Operating Limitations

No Operating Limitations identified.



## 5 INSTALLATION INSTRUCTIONS

**IMPORTANT NOTICE:** All system interconnects cables must be connected before power is applied to the system.

### 5.1 Installation Requirements

When installing the DVI-250 the installer must have a working knowledge of aircraft electronics installation, and be a holder of either an FAA Repairman's Certificate or a Transport Canada equivalent. All installations should meet the requirements of FAA advisory circular AC43.13-1B.

### 5.2 Unpacking and Inspecting

#### 5.2.1 Identifying Your DVI-250

Refer to the MOD Status of your DVI-250. This label is placed on the chassis of the DVI-250. If the MOD Status of your DVI-250 does not match the MOD Status on the title page of this document, please obtain the SOI that applies to your unit from SkyTrac Systems.

#### 5.2.2 Equipment Packing Log

Save the original shipping container in case of need for return due to damage or warranty claims. Check that each item listed on the packing slip has been shipped in the container. Verify and record the Serial Number of the DVI-250. This information is required when contacting SkyTrac Systems to activate the satellite communications services.

### 5.3 Installation Wiring

The DVI-250 has two rear connectors, a 25 pin system connector and a 9 pin programming connector.

The DVI-250 is fully backwards compatible with DVI-200 installations. A DVI-250 can be placed into a DVI-200 installation and it will function as a DVI-200. This is referred to as DVI-200 compatibility mode. In this mode the DVI-200 wiring harness is used to communicate to the ISAT-100. The RS485 wiring is required to support the CDP-250.

The DVI-250 can also be installed to communicate to the ISAT over an RS485 link. The wiring for this mode is much simpler than the DVI-200 compatibility mode.

Please see relevant STC drawings, or if an STC is not applicable, see pages 8, 9 of the latest approved revision of "ISAT-100 Optional Equipment Wiring Diagram" (DOC0029).

**5.3.1 DVI-250 25 Pin Connector Pin-out.**

Pin #	Pin Name	Function/Description
1	Ground	DVI-250 Ground Pin
2	Reserved	Reserved for future use - Do not connect.
3	28V	Connect to 28V.
4	DIM CTRL IN	Input to DVI-250 from aircraft for controlling Bright/Dim mode. Signal may be analog or digital, to a maximum of 28V. Refer to installation instructions and wiring diagram from more information. This pin has a 15k ohm input impedance.
5	DIM CTRL OUT	Output from DVI-250 to ISAT-100 for bright / Dim control, 20V maximum.
6	KEY OUT 0	Keypad Analog Output from DVI-250 to ISAT-100.
7	KEY OUT 1	Keypad Analog Output from DVI-250 to ISAT-100.
8	KEY OUT 2	Keypad Analog Output from DVI-250 to ISAT-100.
9	KEY OUT 3	Keypad Analog Output from DVI-250 to ISAT-100.
10	Send Key	Voltage Sourcing Output from DVI-250 to ISAT-100.
11	BRT/DIM Mode CTRL	Input to DVI-250 from ISAT-100.
12	Reserved	Reserved for future use - Do not connect.
13	Ground	DVI-250 Ground Pin
14	RS-232 RX	RX line of RS-232 Databus to CDP-250. Do not connect if CDP-250 is not used.
15	RS-232 TX	TX Line of RS-232 Databus to CDP-250. Do not connect if CDP-250 is not used.
16	RS-485+	RS-485+ line to ISAT-100 (not required in DVI-200 compatibility mode)
17	RS-485-	RS-485- line to ISAT-100 (not required in DVI-200 compatibility mode)
18	Send Annun.	Ground Seeking Input to DVI-250 from ISAT-100. Controls activation of send annunciator in DVI-200 compatibility mode.
19	Delay Annun.	Ground Seeking Input to DVI-250 from ISAT-100. Controls activation of Data Delay annunciator in DVI-200 compatibility mode.
20	MSG Annun.	Ground Seeking Input to DVI-250 from ISAT-100. Controls activation of MSG IN annunciator in DVI-200 compatibility mode.
21	Reserved	Reserved for future use - Do not connect.
22	ISAT EMERG	Current Sinking output from DVI-250 to ISAT-100. Activating this output via the ISAT EMERG / NORM Switch (toggle or push button type) places the ISAT into ISAT Emergency mode.
23	Reserved	Reserved for future use - Do not connect.
24	Reserved	Reserved for future use - Do not connect.
25	Reserved	Reserved for future use - Do not connect.

### **5.3.2 DVI-150 Upgrade to DVI-250 (working in DVI-200-Compatibility Mode)**

A DVI-150 installation is upgradeable to the DVI-250 installation in DVI-200 compatible mode with some minor wiring additions.

- Wiring for Dimmer control must be added. Refer to Pins 4 and 5 in DVI-200 Wiring Instructions (STS Document Number DVI-200-SYS-DIAG) for more information.
- Your ISAT will also need to be configured to operate with the DVI-250. Please contact SkyTrac to have your ISAT remotely configured.

### **5.3.3 DVI-150 Upgrade to DVI-250 (Working in Normal Mode thru RS485)**

The DVI-150 wiring could be replaced with DVI-250 RS-485 wiring interface.

- The wire between pins 15 and 17 must be removed.
- Positive wire of RS485 interface must be connected to pin 16
- Negative wire of RS485 interface must be connected to pin 17
- Remaining wires can be left in place without affecting DVI operation, or they can be removed or tied off and capped.
- If both the DVI-200/150 and DVI-250 RS485 wiring interfaces are present, the DVI 250 will use the DVI-250 RS485 interface by default.
- Refer to pages 8 and 9 of DOC0029 (ISAT-100 Optional Equipment Wiring Diagram) for details.

### **5.3.4 DVI-200 Upgrade to DVI-250 (working in DVI-200-Compatibility Mode)**

- For the installation where the 28V voltage was applied to pin #25 of the DB-25 connector (as per installation diagram of DVI-200, page 2): Change of wiring is not necessary.
- For the installation where the dimmer bus was applied to pin #2 (the brightness was following the voltage on the dimmer bus), the dimmer voltage must also be applied to the pin #4 (as per installation diagram of DVI-200, page 1).

### **5.3.5 DVI-200 Upgrade to DVI-250 (working in Normal Mode thru RS485)**

- Positive wire of RS485 interface must be connected to pin 16
- Negative wire of RS485 interface must be connected to pin 17
- Refer to pages 8 and 9 of DOC0029 (ISAT-100 Optional Equipment Wiring Diagram) for details.

## **5.4 DVI-250 Installation**

The main tasks for this installation are listed below:

1. Check the contents of the shipping container.
2. Determine the location of the DVI-250.

**Note:** Some factors to be considered to determine install location including ease of access, viewing angle and the affect of glare.

3. Determine if you want to connect the DVI-250 in DVI-250 mode or DVI-200 compatibility mode. The DVI-250 mode provides improved messaging and calling features and it is the recommended mode.
4. Create the wire harness for the DVI-250 as determined in the previous step. For wiring instructions refer to page 8 of DOC0029 (ISAT-100 Optional Equipment Wiring Diagram) for DVI-250 mode, and page 9 of DOC0029 for DVI-200 compatibility mode.
5. Mount the DVI-250 using the DZUS fasteners.
6. Contact SkyTrac Systems to have them remotely activate your DVI and program the text messages. The DVI-250 interface allows you to program the quickdial numbers. Refer to the DVI-250 User's Guide for details. If you are operating in DVI-200 mode, contact STS to program the quick dial numbers.
7. Complete the Post installation test.

#### **5.4.1 Check Contents**

Check the contents of the shipping container as per Section 5.2 Unpacking and Inspecting.

#### **5.4.2 Bright/DIM Control Method (DVI-250 mode only)**

##### **5.4.2.1 Day (Bright) and Night (Dim) Mode Configuration**

If the DVI-250 is operating in DVI-200 compatibility mode, please refer to the DVI-200-OPD-SOI for instructions on how to control the bright/dim mode.

The DVI-250 has two brightness modes - bright (day) and dim (night) mode – with brightness settings preset for day-time and night-time flying conditions respectively. The DVI-250 can be wired to the aircraft dimmer bus so that it can switch seamlessly between these modes based on the aircraft cabin lighting.

The DVI-250 monitors the pin DIM\_CTRL\_IN pin (pin #4) voltage to decide if it is in bright (day) or dim (night) mode. When the voltage is below a threshold voltage called bright mode threshold, the DVI-250 is in bright mode. When the voltage is above a threshold voltage called dim mode threshold, the DVI-250 is in dim mode. The DVI-250 uses a hysteresis window to switch between these two modes. If the DVI-250 is in bright mode, it will switch to dim mode only when the voltage increases above the dim mode threshold. If the DVI-250 is in dim mode, it will switch to bright mode only when the voltage falls below the bright mode threshold.

There are two possible ways to connect the DIM\_CTRL\_IN (pin #4).

1. If DIM\_CTRL\_IN is left unconnected, the DVI-250 will always be in bright (day) mode.
2. If DIM\_CTRL\_IN is connected to the aircraft dimmer bus then the DVI-250 can switch modes based on the aircraft dimmer bus voltage. For example when the aircraft cabin lights are off, the dimmer bus voltage is zero and the DVI-250 goes to day (bright) mode. When the lights are ON, the dimmer bus voltage is positive and when the voltage increases above the dim mode threshold, the DVI-250 goes to dim (night) mode. In the night mode, the backlighting brightness of the key pad buttons follows the aircraft dimmer bus voltage.

Parameter	Value
DIM_CTL_IN – Max Voltage	28 Volts
Dim mode threshold	1.3 Volts
Bright mode threshold	0.7 Volts

The brightness for the indicators (Activity light, Data delay, and Msg In) and backlighting for the keys can be controlled separately.

#### 5.4.2.2 Indicators

The indicators are turned ON to full brightness in bright (day) mode. In dim (night) mode, the indicators brightness is set to medium level of brightness. At any time, the brightness of the indicators can be controlled manually using the keypad function key as indicated in the DVI-250 User's Guide (STS Document Number DOC0039).

#### 5.4.2.3 Backlighting

The backlighting is ON in bright (day) mode. In dim (night) mode, the brightness of the backlighting varies depending on how the DIM\_CTRL\_IN is wired.

1. If DIM\_CTRL\_IN is left unconnected, the backlighting is always ON.
2. If DIM\_CTRL\_IN is connected to the aircraft dimmer bus, but the dimmer voltage is off (below X Volts, the backlighting is ON.
3. If DIM\_CTRL\_IN is connected to the aircraft dimmer bus and the dimmer voltage is above Y volts, then the backlighting follows the dimmer bus voltage.

#### 5.4.3 Wiring Harness

Determine the location of the DVI-250 in order to determine wiring harness lengths. Create the wiring harness for your model of DVI-250 referencing applicable approved installation drawings for your airframe. The wiring diagram shown in Appendix B may be used for reference. Ensure the wiring harness complies with the requirements of FAA advisory circular AC43.13-1B.

#### 5.4.4 Product Mounting

Connect the wiring harness to the rear of the DVI-250, being sure to install all connector mounting hardware required. Mount the DVI-250 to the aircraft DZUS rails using the Dzus fasteners on the DVI-250.

## **5.5 DVI-250 Post Installation Test**

The following post installation function test must be performed after installation of the DVI-250:

### **5.5.1 Function Test Setup**

- Ensure that the wiring harness is securely installed and connected to the ISAT-100 and the DVI-250.
- Apply power to the system. Ensure the ISAT is operating and that its antenna has a clear view of the sky. Refer to the ISAT installation manual for more information on the function of the ISAT.
- To make calls using the DVI-250, voice communication must be enabled in the ISAT. Contact SkyTrac Systems to enable voice communication in the ISAT. The ISAT must receive its programming instructions through the satellite link and therefore needs a view of the sky in order for the voice communication to be enabled.
- The QuickDial numbers can be programmed using the DVI-250 if it is operating in the DVI-250 mode. If the DVI-250 is connected in DVI-200 compatibility mode, contact SkyTrac Systems to program the QuickDial numbers remotely.
- Confirm that the ISAT-100 unit is reporting in FlightTrackSuite

### **5.5.2 Function Test**

- Apply power to the DVI-250 and ISAT-100 systems. Ensure the ISAT is operating and that its antenna has a clear view of the sky. On power-up, the three indicators in the DVI-250 will briefly illuminate simultaneously to indicate correct operation of the DVI-250.
- If the DVI-250 is connected using the DVI-200 wiring, the DVI-250 will indicate the DVI-200 compatibility mode of operation by flashing the Data delay indicator two times (after the power on indication described in the previous step).
- Activate the DVI-250 emergency switch and use SkyTrac's FlightMap Suite to verify that the unit enters ISAT emergency mode. De-Activate the emergency switch and

confirm the unit returns to normal mode. It may take several minutes for the emergency reports to arrive in FlightTrac Suite. Refer to the table below for emergency switch activation / deactivation.

<b>DVI-250 switch type</b>	<b>Activate ISAT Emergency</b>	<b>Cancel ISAT Emergency</b>
Locking toggle switch (DVI250A, DVI250C)	Place the locking toggle switch into the "ISAT EMERG" position (up)	Place the locking toggle switch into the "NORM" position (down)
Pushbutton switch (DVI250AP DVI250CP)	Press and hold the pushbutton for a minimum of 3 seconds or longer (while operating in Normal mode)	Press and hold the pushbutton for a minimum of 3 seconds or longer (while operating in Emergency mode)

- Use the Pre-Programmed text message feature of the DVI-250 to send pre-programmed text message number 5 and confirm it is received in FlightTrack Suite. Refer to the FlightTrack Suite User's Guides for information on how to customize your DVI-250 pre-programmed text messages. The customization of text messages may be done after the installation is complete and does not need to be configured at this time.
- Use the DVI-250 to place a sat phone call. Confirm that the Satellite phone call is established and that audio levels are satisfactory. Refer to the DVI-250 User's Manual (STS Document Number DOC0039).
- Test if the DVI-250 changes between bright (day) and dim (night) modes automatically. Try this test in a suitably dark environment. This test is applicable only if the DVI-250 is wired to the aircraft dimming bus. Turn off the aircraft dimming bus and check if the backlighting for the keys is ON. Now turn ON the aircraft dimming bus and gradually adjust the dimmer bus voltage. Check if the backlighting follows the dimmer bus voltage above the dim mode threshold voltage.
- Press a numeric key and notice the activity light blink. Check if you can adjust the brightness level of the activity light using the DVI-250 function key. Refer to the DVI-250 User's Manual (STS Document Number DOC0039).

### 5.5.3 EMI Test

#### **See DVI-250 EMI/RFI Test Report (STS Document Number DOC0012)**

The purpose of this test report is to verify that the operation of the DVI-250 does not interfere with basic aircraft systems and avionics. Since the DVI-250 cannot operate without an ISAT-100, the DVI-250 and ISAT-100 should be installed and function tested. Note that the EMI tests described in **DVI-250 EMI/RFI Test Report** are intended to test the DVI-250, not the ISAT-100. If the ISAT-100 is also being

installed, then a separate EMI test must be performed. Refer to the ISAT System Installation Manual for more information.

Most of the EMI tests can be accomplished on the ground. In some cases flight-testing is required or is easier. If the aircraft is approved for IFR operations, then it is mandatory that interference between the DVI-250 and the approach aids be checked in-flight.

The existing on-board GPS should be operational and navigating with at least the minimum compliment of satellites. The VHF Communication should be set to commonly used frequencies with the squelch open. VOR/DME receivers should be selected for display. If possible, set up a DME ramp test set on the frequencies indicated and adjust the output until the flags are out of view. The transponder and encoder should be monitored with ramp test equipment. Set the output of the transponder test set to 3db above the output necessary to achieve 90% reply. If possible set the ADF to a nearby navigation station.

Operate the DVI-250 unit for at least 10 minutes. During this time use the keypad on the DVI-250 to send several text messages. These operations will exercise the ISAT-100 to DVI-250 communications link. Because the DVI-250 only instructs the ISAT to place a phone call, it is not necessary to place test phone calls when testing the DVI-250. The DVI-250 does not perform any satellite communication and therefore testing the satellite communication for EMI is out of the scope of this test.

The EMI test for the ISAT (See ISAT-100-OPD-SOI) exercises the ISAT functionality (including satellite communication) and should be completed separately for new ISAT installations.

Observe the GPS for any degradation in satellite status, availability or flags. Listen for any noise or detected audio signals on the VHF Communication. Listen for any noise or detected audio signals on the VOR/LOC receiver audio; look for any movement of flags or needles on the VOR/LOC/GS navigation display(s). Observe the transponder for any loss of reply or spurious reply.

List the power plant, fuel and other electric instruments on the EMI/RFI Test Report and note any anomalies that occur while transmitting. Assess the results.

If the aircraft is equipped with an autopilot or stability augmentation system, then test fly the aircraft and verify that operation of the DVI-250 unit does not have adverse effects on these systems. After checking for gross effects at a safe altitude, fly an approach with each of the different navigation systems coupled to the autopilot (ILS, GPS ETC.) and look for any anomalies.

If the installed system passes all of the applicable EMI tests, then no further action is required. If interference is observed then the interference must be assessed against the appropriate standards of airworthiness for the system in question. For example it is permissible for a VFR certified GPS to lose navigation capability under certain conditions, providing that it recovers properly and promptly, but it is not permissible



for an IFR Approach certified GPS to be affected in the same way. A complete discussion of all the standards of airworthiness to be applied in assessing EMI effects is beyond the scope of this document.

## **6 MAINTENANCE AND CONTINUED AIRWORTHINESS**

### **6.1 Continued Airworthiness**

The backlighting of the DVI-250 is provided by Light-emitting diodes (LEDs). Periodically inspect your DVI-250 for non-functioning LEDs. If an LED is non-functioning, have the LED replaced by an authorized technician.

### **6.2 Maintenance Instructions**

With the exception of the lighting as explained in Section 6.1 above, the DVI-250 does not require any maintenance.

## **7 APPENDIX A MECHANICAL DIAGRAMS**

## **8 APPENDIX B INSTALLATION DIAGRAMS**

Please see relevant STC drawings, or if an STC is not applicable, see pages 8, 9 of the latest approved revision of "ISAT-100 Optional Equipment Wiring Diagram" (DOC0029).